THE TELEGRAPHIC JOURNAL.

VOL. III.—No. 67.

SIR CHARLES WHEATSTONE.

CHARLES WHEATSTONE was born in Gloucester, in the year 1802. He was the son of a tradesman. He was educated in a private school in that city. He commenced early to fight the battle of life by the manufacture of musical instruments, an occupation which encouraged his natural taste for science and mechanics. In 1823, he moved up to London, and established a business of his own. The natural scientific bent of his mind drove him to search deeply into the physical laws upon which the instruments he made were based, and in the same year that he removed from Gloucester, he published, in the *Philosophical Annals*, an account of some "New experiments on sound." In 1827 he published in the *Quarterly Journal of Science*, "Experiments on Audition," and a "Description of the Kaleidophone, or phonic Kaleidoscope, a new philosophical toy for the illustration of several interesting and amusing acoustical and optical phenomena." In 1828 he wrote on the resonance of columns of air, and in 1831 on the transmission of musical sounds through solid conductors. In the latter year he gave an experimental proof of Bernouilli's theory of wind instruments, and in 1833 he read a paper before the Royal Society on those peculiar figures called "Cladni's" made by sand on vibrating plates. In 1832 he read a remarkable paper on Dreaming and Somnambulism, and he never ceased throughout his long life in taking deep interest in mental illusions and psychological problems. In 1835 he sent a paper to the British Association "On the various attempts which have been made to imitate human speech by mechanical means," and he made a machine which imitated very successfully some of the simple elementary sounds of the human voice.

In 1834 he was appointed Professor of Natural Philosophy in King's College, and in the same year he made his celebrated and classical experiments on the velocity of an electric discharge and the duration of the sparks by the aid of revolving mirrors; and from this period his mind seems to have been devoted to telegraphy. No one who had ever studied electricity could have failed to have seen its special adaptability to the conveyance of intelligence to distant points; and from Lesarge, in 1774, to Schilling in 1832, a dozen or more telegraphs were "invented" and freely given to the world. No one can claim the "invention" of the telegraph. Neither Wheatstone, nor Cooke, nor Morse were the first to employ electricity for telegraphic purposes, nor the first to convey intelligence to a distant point by means of electricity. The controversy on this point has been an unfortunate one. Sir Francis Ronalds in 1823 wrote a book on the subject, and his prescience is wonderful to contemplate; but he only described in an improved form what Lomond had done in 1787. Cooke and Wheatstone introduced the telegraph into England, and invented certain means for carrying on telegraphy in a practical form, and they were the first to do this.

In 1835 Wheatstone exhibited to his class, in King's College, Schilling's single needle apparatus, and in the next year Sir W. Cooke became acquainted with that instrument at Heidelberg. The deep foresight and commercial spirit of the latter at once grasped the value of telegraphy to the railway world that was then springing into existence, and through the introduction of Faraday and Roget, Cooke and Wheatstone were brought into contact, and the ideas of each were amalgamated and perfected. In 1837 they produced the five needle or "hatchment" telegraph, which was subsequently modified into the double needle and finally into the present single needle instrument. In 1840 they produced an alphabetical dial telegraph. In 1841 Wheatstone produced alone a type printing telegraph and a new magneto-electric machine, and in 1845 Cooke and Wheatstone jointly patented several improvements and additions to their previous apparatus. Cooke about this period retired from the world of invention, but his partner never ceased to apply his active and practical mind to the improvent of the child that had now grown a giant. In 1858 and 1860 Wheatstone alone produced his beautiful A B C apparatus, and in 1858 his automatic apparatus, which was still further improved in 1867. It was while watching the progress of this last, and perhaps most perfect of his numerous inventions, that he was taken with that illness which proved fatal to him.

It is impossible to separate the names of Cooke and Wheatstone from the introduction of telegraphy into England and thence into the world, for it is idle to deny that its practical success in England preceded its introduction in any other country. The Americans claim the invention of his electro-magnetic telegraph for Morse in 1832. They are welcome to it; nevertheless, the first practical line was not put up in that country until 1844. The first line in England was constructed for practical purposes, paid for and worked by the Blackwall Railway in 1838. It was Cooke's indomitable energy, sanguine temperament, prac-

tical mind, and business habits which introduced telegraphy into England; and Wheatstone was the scientific man, whose profound knowledge, fertile intellect, and marvellous ingenuity enabled Cooke to surmount every difficulty. The two together forced telegraphy into existence against scepticism, conservatism, and inertia of the gravest character. It took fourteen years to establish telegraphy as a profitable business, and none but those who were engaged in the early struggles of English telegraphists know the energy, determination, and patience of the partner who followed his old and valued friend—from whom he had been separated for nearly thirty years, chiefly by the injudiciousness of friends — to his last resting-place, in Kensal-green, on that cold, raw, October morning.

In 1840, Wheatstone suggested submarine telegraphy, and drew up a scheme with wonderful prescience and prophetic skill to overcome the difficulties which were afterwards encountered. In 1843 he sent to the Royal Society "An account of several new instruments and processes for determining the constants of a voltaic circuit" — a paper which was the foundation of all exact measurements of electrical elements. In it he described the far famed Wheatstone's bridge, or, as he called it, the *differential resistance measurer*, which, though previously described by Christie, will always be known as Wheatstone's bridge, and he suggested a *unit* of electrical resistance sometimes known as Wheatstone's "foot," for it was a foot length of copper wire, weighing 100 grains. He also pointed out the use of the present universal "shunt" or "reducing wire" as he called it, and he designed the rheostat, or set of resistance coils. He gave during that year the Bakerian lecture on this subject.

In 1840 he invented his "Chronoscope," an instrument for measuring the duration of small intervals of time. It has been largely applied to measure the velocity of projectiles. It is composed of a clock movement, set free at the moment of the ball's exit from the gun, and stopped when it reaches the target. A wire at the gun's mouth is broken at the instant the ball passes out of the gun, and the circuit is completed the instant the ball reaches the target. This is the basis of all subsequent chronoscopes.

In 1843 he proposed to register meteorological observations, such as the temperature and pressure of the air, by the contact of mercury with a platinum wire in the tube of the barometer or thermometer; and his plan was extended to register the direction and force of the wind; the temperature and volume of water in a well; the temperature of a greenhouse; the number of visitors entering a building; the number of copies struck from a printing press, and numerous other useful actions.

In 1835 he read a paper before the British Association, in which he anticipated the modern science of spectrum analysis. He experimented on the bright lines of light emitted on the volatilisation of metals by currents of high potential, and showed that they differed in colour and position with every metal employed as an electrode. In 1838 he invented the Stereoscope, which, since the introduction of photography, has become a household drawing-room ornament and instrument. He showed that our conception of solidity was due to the mental union of two dissimilar perspectives. In 1852 he sent to the Royal Society a second paper on binocular vision, and described the Pseudoscope, an instrument which makes concave objects appear convex, and *vice versa*.

His last invention was a new recording instrument for submarine cables, formed by a globe of mercury moving to and fro in a capillary tube containing acid. It is said to be 58 times more sensitive than any previous recorder.

It is impossible even to summarise his wonderful exploits in the field of science. He experimented on every subject, from gyroscopes to captive balloons. The catalogue of the Royal Society contains thirty-one headings of his papers. Heat, light, electricity, sound, all received his attention at different periods. The Arctic ships, under Captain Nares, possess one of his most beautiful instruments—his *Polar clock*—which tells the time of day by the hourly changes in the plane of polarization of light. The Royal Institution in Albemarle-street and Burlington House are fitted up with his electric clocks. Every daily paper is indebted to his automatic apparatus for the news it prints. Every country squire is indebted to his magnetic A B C for the opening of the village post-office as a telegraph station.

He died full of honour. In 1836 he received the mystic letters, F.R.S. In 1855 he was made a Chevalier of the Legion of Honour. In 1873 he was made a Foreign Member of the Institute of France. He had no less than 34 foreign distinctions or diplomas, and in 1868 he was knighted.

Though his papers are the models of clearness and preciseness, he was a very poor lecturer, and though as a conversationalist on his favourite subjects he was unrivalled, his volubility forsook him in the face of numbers. His great exponent at the Royal institution was Faraday, who loved to lecture upon his friend's "beautiful developments," and one of whose last lectures in that celebrated arena was on the A B C apparatus.

His bibliographical knowledge was marvellous.

He seemed to know every book that was written, and everything that everybody had ever published. If any information was desired on any subject, there was no surer guide to fall back upon than Sir Charles Wheatstone. His power of deciphering hieroglyphics, puzzles, and cypher despatches, was something inexplicable. He seemed to divine the meaning of any paradoxical puzzle put before him instinctively; while, on the other hand, his ingenuity devised the cryptograph, or secret despatch writer, which is apparently inscrutable.

Wheatstone added no great fact to the science of Electricity. His mind was devoted not so much to probing the secrets of nature, like Faraday, as to turn those secrets discovered by others to practical use, not so much to develope news laws, like Ohm, as to verify those laws and turn them to useful purposes. He was essentially a practical man.

Many bright spirits and brilliant intelle ts have adorned this nineteenth century, but there is no name which, in the pages of the future, will shine with greater brilliancy than that of Charles Wheatstone. The great lesson to be learnt from the life of Wheatstone, like that from the life of Faraday, is that in the great Republic of Science birth and wealth are of no advantage to those who seek honour and renown. Every distinction which the State and the world could afford were showered on both, and each showed that intellect, aided by self-help and probity, will raise the humblest peasant into the highest positions of honour and respect.

BRIEF SUMMARY OF TELEGRAPHS PRIOR TO THE YEAR 1838.

Lesarge, in 1774, employed twenty-four wires and a pith-ball electrometer.

Lomond, in 1787, employed one wire and a pith-ball electrometer.

Betancourt, in 1787, used one wire and a battery of Leyden jars.

Reizen, in 1794, had twenty-six wires: the letters of the alphabet were cut out in pieces of tinfoil, and rendered visible by sparks of electricity.

Cavallo, in 1795, used one wire; the number of sparks was made to designate the various signals, and the explosion of gas was used for an alarum.

Salva, in 1796. The exact particulars of this telegraph are doubtful.

In all the above plans, high-tension electricity was to be employed.

Soemmering's telegraph, of 1809 or 1811. In this telegraph galvanic electricity was used, and as many wires were employed as there were letters or signals to be denoted. The letters were designated by the decomposition of water; an alarum was also added.

Schwieger employed the principle of Soemmering's telegraph, but reduced the number of wires to two. He also proposed the printing of the letters.

Coxe's telegraph, in 1810. Coxe proposed the use both of the decomposition of water and also of metallic salts.

Ronalds's in 1816. In Ronalds's telegraph high-tension electricity was employed. The wires used were laid under-ground as well as suspended in the air. A pith-ball electrometer, hung before a clock-movement, enabled the letters on a dial to be read off. The sounding of an alarum by exploding gas, &c., was also added.

Ampère, in 1820. Ampère employed the magnetic needle, the coil of wire, and the galvanic battery, and proposed the use of as many wires as letters or signals to be indicated.

Tribaollet, in 1828. Tribaollet's telegraph required but one wire, and this was buried in the earth. A galvanic battery and a galvanoscope were employed.

Schilling's telegraph, in 1832. Schilling employed five magnetic needles and had also a mechanical alarum. In another telegraph of Schilling's one needle and one wire only were used.

Gauss and Weber, 1833. In the telegraph of Gauss and Weber one wire and one needle only were needed. The power employed was magneto-electricity.

Taquin and Ettieyhausen, in 1836. The particulars of the telegraph of these parties are at present uncertain.

Steinheil's telegraph, 1837. This telegraph required only one wire and one or two magnetic needles. The power used was magneto-electricity. Steinheil had a printing telegraph as well as a means of telegraphing by sounds produced by electric apparatus striking bells.

Masson's telegraph, 1837 and 1838. In this telegraph magneto-electricity was employed in conjunction with magnetic needles.

Morse's telegraph, 1837. Morse's telegraph was a printing or recording telegraph; it required only one wire, and galvanic electricity was used. An electro-magnet of iron was used for attracting an armature, to which was attached a pricker or pen to mark paper, which was made to pass underneath it.

Vail's telegraph, 1837. This was a telegraph for printing the letters of the alphabet. One wire only was used. Clockwork mechanism, regulated by pendulums was also added.

Davy's telegraph, 1837. In this telegraph magnetic needles and coils of wire were used. The needles removed screens which previously rendered the letters invisible.

Alexander's telegraph, 1837. Thirty magnetic needles and thirty wires were required in this plan. Each needle removed a screen which obscured a letter painted behind it.

Previous to 1837 we have, therefore, no less than fifteen telegraphs, and in 1837 no less than six new arrangements of telegraphs, exclusive of the one of Messrs. Cooke and Wheatstone, which was patented in June, 1837.

In the Ordnance Survey, Southampton, engraved copper plates 3 ft. by 2 ft., and electrotyped by very large Smee cells, ½lb. of copper is deposited per square foot in 24 hours, and by raising the temperature, 1 lb. per square foot can be deposited in the same time.

The following remarkable anticipation of the Electric Telegraph is a copy from an Edition of Strada's Prolusions in the Bodleian Library at Oxford.

It is the basis upon which the Italians claim the Electric Telegraph as an Italian idea, brought into use by means of the inventions of Volta and Galvani—Italians.

" Famiani Stradæ Romani è Societate Jesu Prolusiones Academicæ
Juxta exemplar Authoris recognitæ, atque suis Indicibus illustratæ.
Oxoniæ, Excudebat Gulielmus Turner Academiæ celeberrimæ Typographus
MDCXXXI. Lib II. Prol: VI. Poet: Academia II. (p. 238.)"

"Lucretii stylus.

" Magnesi genus est lapidis mirabile, cui si
Corpora ferri plura stylosve admoveris; inde
Non modò vim, motumque trahent, quo semper ad Ursam,
Quæ lucet vicina polo, se vertere tentent:
Verùm etiam mira inter se ratione modoque
Quotquot cum lapidem tetigêre styli, simul omnes
Conspirare situm motumque videbis in unum.

Ferrei styli tacti a magneti servantes mutuum motum distracti distantesque.

Ut si fortè ex his aliquis Romæ videatur,
Alter ad hunc motum, quamvis sit dissitu longè
Arcano se naturäi fædere vertat.

Planus orbis literis circumscriptis.

Ergo age, si quid scire voles, qui distat, amicum,
Ad quem nulla accedere possit epistola; sume
Planum orbem patulumque, notas elementaque prima
Ordine, quo discunt pueri, describe per oras
Extremas orbis, medioque repone jacentem,
Qui tetigit magneta, stylum; ut versatilis inde
Literulam, quamcunque velis, contingere possit.
Hujus ad exemplum, simili fabricaveris orbem
Margine descriptum, munitumque indice ferri,
Ferri quod motum magnete accepit ab illo.

Ratio alloquendi absentum absque nuncio et epistola

Hunc orbem discessurus sibi portet Amicus,
Conveniatque priùs, quo tempore, queisve diebus
Exploret, stylus an trepidet, quidve indice signet.
His ita compositis, si clàm cupis alloqui amicum
Quem procul a tete terräi distinet ora;
Orbi adjunge manum, ferrum versatile tracta
Hîc dispôsta vides elementa in margine toto
Queis opus est ad verba notis, huc dirige ferrum,
Literulasque, modo hanc, modo et illam cuspide tange,
Dum ferrum per eas iterumque iterumque rotando,
Componas singillatim sensa omnia mentis.

Mira fides! longè qui distat cernit amicus,
Nullius impulsu, trepidare volubile ferrum,
Nunc hùc, nunc illuc discurrere: conscius hœret,
Observatque styli ductum, sequiturque legendo
Hinc atque hinc elementa, quibus in verba coactis,
Quid sit opus sentit, ferroque interprete discit,
Quin etiam cùm stare stylum videt, ipse vicissim,
Si quæ respondenda putat, simili ratione,
Literulis variè tactics, rescribit amico.

Ratio respondendi eodem modo.

Commoda hujus inventi."

O, utinam hæc ratio scribendi prodaut usu;
Cautior, et citior properaret epistola, nullas
Latronum verita insidias fluviosque morantes.
Ipse suis Princeps manibus sibi conficeret rem:
Nos, soboles scribarum, emersi ex æquore nigro,
Consecraremus Calamum Magnetis ad Oras!"

N.B.—Strada natus 1572, obiit 1649.

TRANSLATION.

THERE is a wonderful kind of magnetic stone to which, if you bring in contact several bodies of iron or dial-pins, from thence they will not only derive a force and motion by which they will always try to turn themselves to the bear which shines near the pole, but, also, by a strange method and fashion between each other, as many dial-pins as have touched that stone; you will see them all agree in the same position and motion, so that, if by chance one of these be observed at Rome, another, although it may be removed a long way off, turns itself in the same direction by a secret law of its nature. Therefore try the experiment, if you desire a friend who is at a distance to know anything to whom no letter could get; take a flat smooth disc, describe round the outside edges of the disc stops, and the first letters of the alphabet, in the order in which boys learn them, and place in the centre, lying horizontally, a dial pin that has touched the magnet, so that, turned easily from thence, it can touch each separate letter that you desire. After the pattern of this one, construct another disc, described with a similar margin, and furnished with a pointer of iron—of iron that has received a motion from the same magnet. Let your friend, about to depart, carry this disc with him, and let it be agreed beforehand, at what time, or on what days, he shall observe whether the dial-pin trembles, or what it marks with the indicator. These things being thus arranged, if you desire to address your friend secretly, whom a part of the earth separates far from you, bring your hand to the disc, take hold of the moveable iron, here you observe the letters arranged round the whole margin, with stops of which there is need for words, hither direct the iron, and touch with the point the separate letters, now this one, and now the other, whilst, by turning the iron round again and again throughout these, you may distinctly express all the sentiments of your mind.

Strange, but true! the friend who is far distant sees the moveable iron tremble without the touch of anyone, and to traverse, now in one, now in another, direction; he stands attentive, and observes the leading of the iron, and follows, by collecting the letters from each direction, with which being formed into words, he perceives what may be intended, and learns from the iron as his interpreter. Moreover, when he sees the dial-pin stop, he, in his turn, if he thinks of any things to answer, in the same manner by the letters being touched separately, writes back to his friend.

Oh, I wish this mode of writing may become in use, a letter would travel safer and quicker, fearing no plots of robbers and retarding rivers. The prince, with his own hands, might dispatch business for himself. We, the race of scribes, escaped from an inky sea, would dedicate the pen to the Shores of Magnet.

N.B.—Strada was born 1572 and died in 1649.

NOTE.—Addison, in the *Spectator*, No. 241, 6th December, 1711, alludes to Strada's idea as a "chimera," and which, but for the discovery of the Galvanic, or Voltaic-Battery, it might have remained.

ON THE TELEGRAPHIC PROBLEMS OF DOUBLE SENDING AND QUADRUPLEX TELEGRAPHY.

By G. K. WINTER,
Telegraph Engineer to the Madras Railway.

(Continued from page 236.)

PART II.

A SECOND method of double sending which I have successfully worked, follows, almost as a matter of course, from the system previously described.

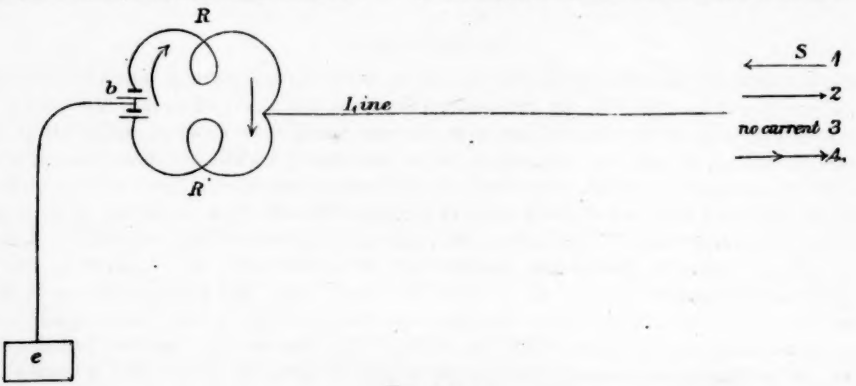

FIG. 12.

Let *b* be a battery, R and R¹ two relays, and let them be joined up with earth, and line in the manner shown on fig. 12. Let S be the distant station, and let the four combinations of the keys at that station produce the currents represented by the arrows, &c., opposite 1, 2, 3, 4, respectively. The current represented by the arrow opposite 1 will aid the local current through R¹, but will neutralise that in R. Again, the current represented by 2 will aid the local current in R, but will neutralise that in R¹. No current, represented by 3, will simply allow the local current to flow through both relays, and the double current represented by 4, will not only neutralise the local current in R¹, but will cause a current in it in the opposite direction to that in which the local current is flowing. Let both relays be polarised and so connected as to be worked by the local current. If now R¹ be a relay with two tongues, the position of rest of one of them being against the insulated stud, and that of the other against the central point; while the position of rest of the tongue of the relay R is against the insulated stud, and the tongues joined up as shown by fig. 13, we shall have exactly an analagous action in the relays to that described in the first part of this paper. This system possesses certain advantages over the system previously described; it is simple in theory,

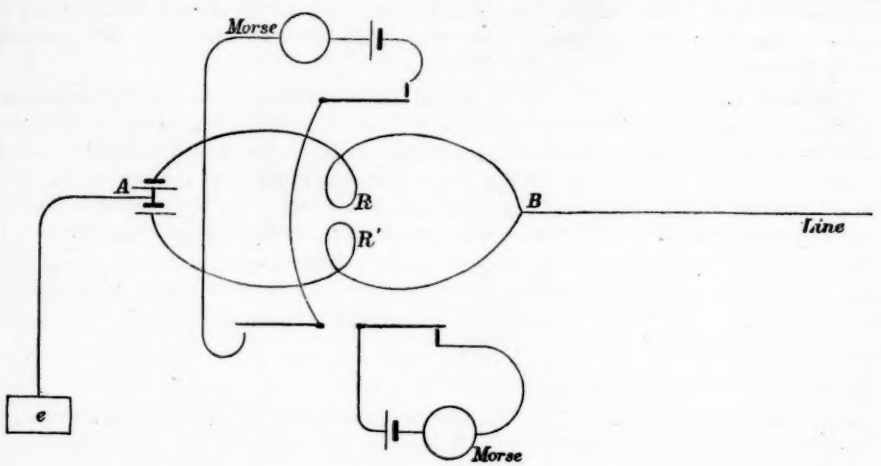

FIG. 13.

requires less battery power, and necessitates neither a differentially wound relay nor a bridge arrangement.

N.B.—The tongues are shown in their positions of rest.

This system works exceedingly well, and of

course the same arrangement of keys will suit either method. In order to duplex this system, we join the two branches of the bridge to the points A and B, and put a resistance coil between A and earth, adding condensers to this coil if necessary. Since the first part of this paper left, I have worked the quadruplex arrangements described without any difficulty.

It is very desirable that the currents should be properly balanced in the relays R and R¹, and it is also evident that the resistances of the two branches in which they are placed should be equal. In order to secure those conditions I make the following arrangements:—

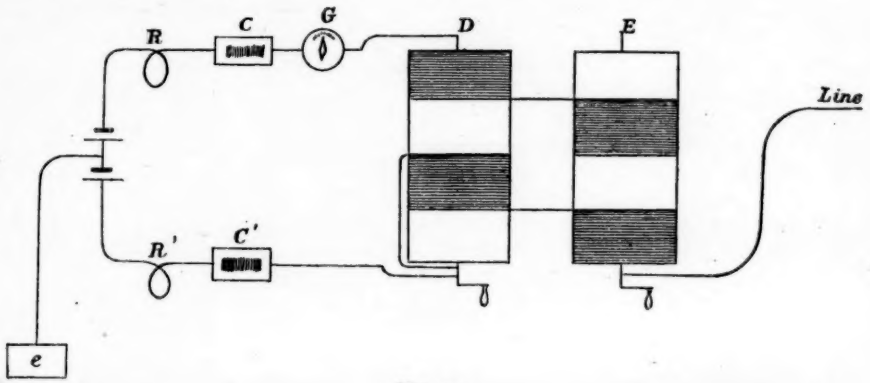

FIG. 14.

R and R¹ are the two relays as before, C and C¹ are two resistance coils for coarse adjustment, G a galvanometer, and D and E are two barrels of a rheostat by which the finer adjustments are made; the barrel D is of ebonite or other insulating material, and the barrel E is of brass or other conductor; by turning the barrels equal increments or decrements are effected in the resistances of the two branches.

We will now analyse the changes in the positions of the tongues of the relays which are caused by the action of the keys.

Fig. 15 shows the position of the tongues and the direction of the currents when both keys are at rest. It is seen that both the tongues t t^1 of relay R¹ are open, while the tongue t^{11} of relay R is closed. Both local circuits are therefore open.

Now suppose that key to be pressed which causes a current ——> in the line.

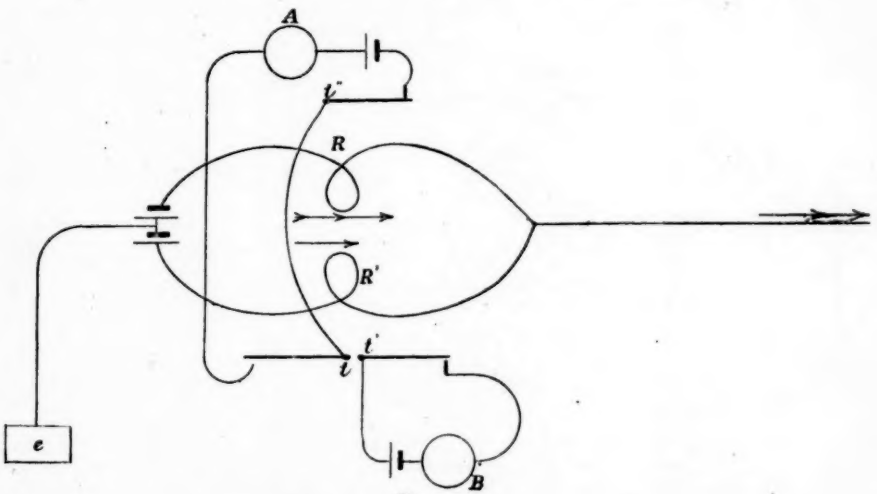

FIG. 15.

The current in R is simply reduced from three units to two units, so that tne tongus t^{11} continues closed. The current R¹ is neutralised, so that the tongue t falls to its position of rest against the conact points, and thus completes the circuit of

the Morse A. The tongue t^1 remains against the insulated stud, as that is the position of rest; the current of Morse B is therefore open. When the key is raised the tongue t simply falls back against the insulated stud, and thus breaks the circuit of Morse A. We will call this key A, and we see that it works the Morse A when it alone is worked.

Now let the key B be depressed, producing a current <—— in the line.

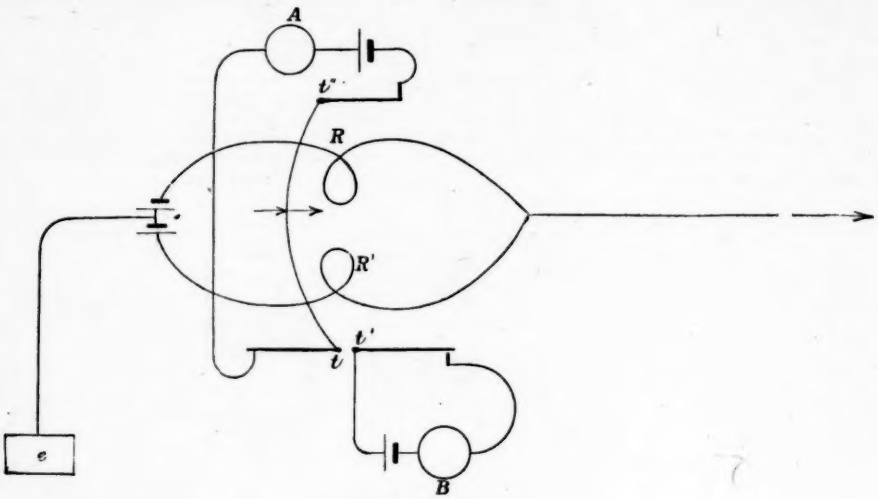

FIG. 16.

The current in R is now neutralised, while that in R^1 is two units in the direction of its working. The tongue t^1 closes the circuit of Morse B. The tongue t also comes against its contact point, but the tongue t^{11} of relay R is opened, and it is evident that the tongue t has to perform a journey before it reaches the contact point, while the tongue t^{11} breaks the circuit as soon as it begins to move, so that a little care in the adjustment is all that is

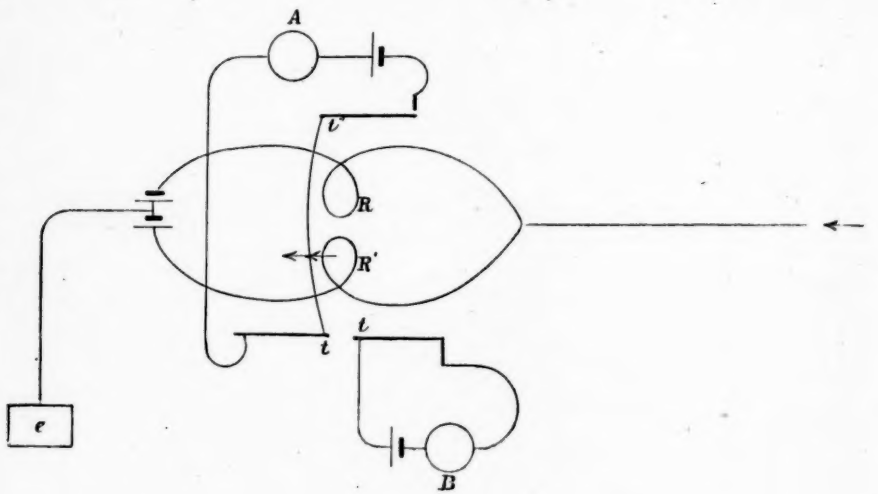

FIG. 17.

required to prevent any kick at this change. The same may be said when the key B is raised and the tongues go back to their normal position; the tongue t^{11} has to perform a journey before it reaches a contact point, while the tongue t breaks the circuit directly it begins to move. These are the only changes which involve the motion of more than one tongue at a time, and it is clear that a kick can only be produced in the event of one of the tongues t or t^{11} reaching its contact point before the other breaks the circuit by commencing to move to the insulating stud. Practically a little care is necessary to prevent this kick.

Next let us suppose the key A to be kept depressed, and that we work with key B. The current in the line which is ———> when the key B is up, becomes zero when key B is depressed. The position of the tongues when key A alone is depressed, is shown in fig. 16, both t and t^{11} are closed, and only t^{1} is open. The reduction of the line current to zero produces the effect shown in fig. 18.

Thus the working of the key B while A is depressed, simply causes the closing and unclosing of the circuit of Morse B by the action of the tongue t^{1}.

Lastly, suppose the key B to be depressed and the key A worked. The state of things when B alone is depressed is shown in fig. 17, in which both tongues of relay R^{1} are closed, and only the tongue of t^{11} of relay R is open. It is evident that the reduction of the line current to zero by the depression of key A, will simply cause the closing of the circuit of Morse A by the tongue t^{1}, and this tongue alone will fall back and open the circuit of Morse A when the key A is raised.

I hope to examine the American methods in a future paper; all I need say now is that they are open to the same objections as those pointed out in the earlier systems, and it is difficult to understand how success could possibly have attended their working.

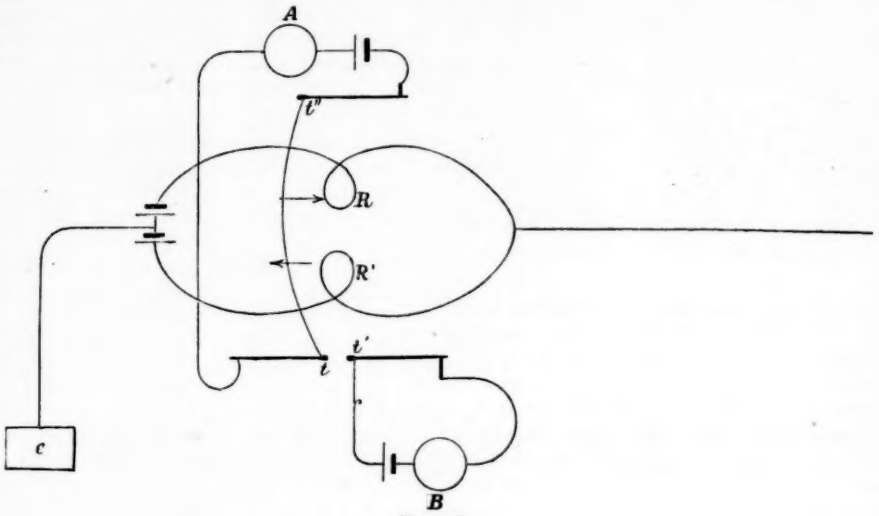

FIG. 18.

Notes.

THE Direct United States Cable was successfully repaired and communication re-established on the 4th instant. Both companies are now forwarding messages at the rate of 3s. per word.

The *Hibernia*, with the remainder of the New Zealand Cable, has left the Thames. She was unfortunate enough to run ashore in a fog, but got off without damage.

The traffic receipts of the Direct Spanish Telegraph Company (Limited) for the month of October were £1,580, against £1,386 in the corresponding period of last year.

From the 1st November the rate between London and any station in Spain by Direct Spanish Cable between the Lizard and Santander will be 7s. for a Telegram of 20 words.

At the adjourned meeting of Hooper's Telegraph Works (Limited), the report of the committee of investigation was adopted, and it was proposed to raise about £50,000 on debentures.

The receipts of the Submarine Telegraph Company for the month of October, 1875, amounted to

£10,918, against £9,910 for the corresponding month of last year.

The traffic receipts of the Great Northern Telegraph Company for the month of October amounted to 387,084f., against 420,885f. last year; and the total traffic receipt, from 1st January to 31st October amounted to 3,574,032f., against 3,748,925f. last year.

The Eastern Telegraph Company's receipts for the month of October amounted to £35,757, against £32,853 in the corresponding period of 1874; and those of the Eastern Extension Australasia and China Telegraph Company, to £19,604, against £16,584 for the corresponding period of 1874.

Few bodies are more easily electrified than collodion. With the least friction by the hand, the membrane adheres to the fingers. If a collodion sheet be fixed, like a flag, to a glass tube, and waved in dry and hot air, it is electrified.

Mr. Moxon has introduced, on the Lancashire and Yorkshire Railway, a new right and left Morse printing apparatus. The characters are not made in dots and dashes, but in dots only, on different lines, in what is known as Steinheil's Alphabet. The messages as recorded are very compact and legible, and there can be no doubt that considerable speed is gained. It is in use on a busy single needle circuit, for it is worked by the same means and by the same alphabet as the single needle instrument.

Prof. Palmieri has discovered a new instrument which he calls the "diagometer," and which is constructed for the rapid examination of oils and textures by means of electricity. What the apparatus will do Prof. Palmieri details thus: 1. It will show the quality of olive oil. 2. It will distinguish olive oil from seed oil. 3. It will indicate whether olive oil, although of the best appearance, has been mixed with seed oil. 4. It will show the quality of seed oils. 5. Finally, it will indicate the presence of cotton in silken or woollen textures. The professor has been complimented for this invention by the Chamber of Arts and Commerce at Naples, who have published a full description of the apparatus, with instructions for use.—(*Nature.*)

In an amusing article on "Insular Egotism" the *New York Telegrapher* gravely publishes the following interesting information:—In no other country has telegraphy acquired such perfection in actual use or been so universally adopted and used by the people as in the United States and Canadas. More actual business is transmitted daily on a single circuit by two operators in this country than by four operators on two circuits on the English lines. Business is dribbled over the English lines slowly by means of needle telegraphs or by Morse registers, the use of which is universal there but exceptional here; and the automatic telegraph of Wheatstone gives a speed of seventy to eighty words per minute in actual business against 1,200 to 1,500 words per minute by the American automatic system.

The use of ebonite, one of the newer preparations of Indiarubber is constantly increasing, on account of its better applicability to many purposes in the arts than its near ally, vulcanite. The two substances are quite similar, being composed of Indiarubber and sulphur, with some preparation of gutta percha, shellac, asphalte, graphite, etc.; although these latter are not essential. In vulcanite the amount of sulphur does not exceed 20 to 30 per cent., whereas in ebonite the percentage of sulphur may reach as high as 60. An increased temperature is also required for this preparation. The approved formula consists in mixing together 100 parts of rubber, 45 of sulphur and 10 of gutta percha, with sufficient heat to facilitate the combination. In manufacture, a sufficient quantity of this mixture is placed in a mould of a desired shape, and of such material as will not be affected by the sulphur contained in the mass. It is then exposed to heat of about 315°, and a pressure of about 12 pounds to the square inch, for two hours. This is done most readily by placing the mould in a steam pan, where the requisite pressure and temperature can easily be kept up. When cold the ebonite is removed from the mould, finished and polished in the usual manner.—(*Journal of the Telegraph*).

In our number for the 16th of April last we made mention of a new system of rapid and simultaneous telegraphy, the invention of Major Barney, an American, which had been tried on the Government lines and found to give very satisfactory results. Since that time, agreeably to Mr. Barney, some modifications have been made in the system by Mr. Godener, a Frenchman and pupil of Bréguet, and later experiments have given still more satisfactory promise than those made at first. The following are some of the results:—On the 1st of July, the same dispatch was transmitted simultaneously to Ostend and Antwerp from Brussells, with a velocity of 600 words a minute. These trials took place on the lines between Brussels and Ostend and Brussels and Antwerp, the lines having been joined at Brussels in order to obtain increased length of circuit; the first was 156 miles, and the second about 57 miles long. July 17th, messages were sent from Ostend to Brussels with a velocity of 1,092 words per minute (all being read by the employés present). August

25th, messages were transmitted from Brussels *via* Arlon and back, a distance of about 237 miles, at a velocity of 600 words per minute and read by the employés of the office. There is reason to congratulate the railroad, post and telegraphic administration for having, in the interest of science and progress, placed their lines at the disposal of the experimenters.—(*L'Independence Belge*).

The Count du Moncel, our readers may be aware, has been engaged some time in studying the electric conductivity of substances that are but moderately good conductors. In his last note to the Paris Academy on the subject he states the following conclusions he has arrived at: 1. The metallic minerals, when they have a certain degree of conductivity, generally give, when under the influence of heat, thermo-electric effects, and this increases or diminishes the conducting power of the mineral according as its resistance is greater or less. 2. Some metallic minerals may present electrostatic and electrotonic effects (so remarkable in hard stones—silex in particular), but with these are joined effects from thermo-electric actions, which generally predominate; in all cases these minerals are not impressionable by the moisture of the air. 3. Such minerals are comparatively resistant, but less than ordinary stones, and consequently the heat increases their conductivity. 4. Minerals which have a great metallic resistance, and have not a well-developed electrostatic capacity, present a very weak metallic conductivity, but they give sensible thermo-electric currents and heat slightly increases their conductivity. 5. Minerals which only possess a well-developed metallic conductivity give intense thermo-electric results, but the heat diminishes their conductivity and the effects resulting from electrotonic conductivity are not met with.

It is proposed to hold an Electrical Exhibition in Paris in 1877. It will be held in the Palais de l'Industrie, the object being to illustrate all the applications of electricity to the arts, to industry, and to domestic purposes. This project, which was initiated by Count Hallez d'Arros, has been received with general favour both by the scientific and industrial worlds, and the necessary funds have been already guaranteed. An organising committee is formed, and the provisional offices of the Exhibition have been established at 86, Rue de la Victoire. This committee has held its first general meeting at the Palais de l'Industrie, Paris, under the presidency of Colonel Laussedat, one of the delegates appointed by the French Minister of War. The committee approved the regulations proposed by Count Halley d'Arroz, the originator of the scheme, appointed him general director, and divided the exhibition into eighteen groups. Amongst these are the History of Electricity, a section in which will be collected, as far as possible, the instruments which were used by Davy, Faraday, Volta, Arago, Ohm, Oersted, Ampère, and others, in making their discoveries. The eighteenth group will be Bibliographical; a library as complete as possible will be formed of all the books and papers published in the Transactions of the several Academies, and scientific periodicals relating to electricity. A requisition will be sent to the administration of the National Library, asking them to offer, for 1877, their systematic Catalogue of Electricity. The President of the French Republic will be the head of the Committee of Patronage, and a sub-committee has received instructions to open negotiations with foreign *savants* and Governments.—(*Nature.*)

Under date of Sept. 5th the *New York Herald's* correspondent at Lima, Peru, writes concerning telegraph matters in Peru, Chili, and Bolivia, as follows:—The *Dacia* and *International*, steamers in the service of the I. R., G. P. and Telegraph Works Company, have successfully concluded their work on the coast, and a submarine cable now connects Chorillos, a watering place nine miles from Lima, with Caldera, in Chili, whence telegraphic communication may be had, *via* Valparaiso and Santiago, with Buenos Ayres and Montevideo, and from these last-named cities to Europe and North America by way of Rio Janerio, Bahia and Lisbon. The coast line touches at Mollendo, Arica and Iquique, passing then to Bolivian territory at Cobija, and thence to Caldera. The first messages were despatched by Mr. Pardo to the Presidents of Chili and the Argentine Confederation, and to the Emperor Don Pedro, of Brazil, congratulating them upon the new link established between the respective countries. The enterprise should prove to be a profitable one, but the tariff now fixed is so excessive that the privileges afforded by the cable are, *ipse facto*, placed beyond the reach of the great majority of merchants. Even for despatches between the coast stations of Peru a charge of twelve hard dollars for ten words is exacted, making correspondence more than expensive. A curious feature is to be noticed, however. The Minister of the Interior, in a circular addressed to the different prefects, sub-prefects, and other officials of the government in the South, orders them in their communications sent over the wire to suppress all ceremonious terms, and even to address the President of the Republic as a simple, private citizen, leaving out the interminable "Your Excellency," and "May God keep you under his protection for years to come." It is shrewdly suspected here that this order of the Minister is

by no means agreeable to the telegraph company, as their profits will be notably diminished thereby; but the wishes of the Secretary are paramount.

The soundings for the projected cable between Sydney, New South Wales, and Wellington, New Zealand, which have been in progress for some months past by H. B. M. Ship *Challenger*, show that no unfavourable conditions exist in regard to the suitability of the route and the character of the bed. Captain Nares, of the *Challenger*, has communicated the following report to Sir Hercules Robinson, Governor of New South Wales, as the result of the survey:—On the Australian coast the incline from the 100 fathoms line, which was 17 miles from the land, into a depth of 2,100 fathoms at 57 miles distance, was about 1 in 20, which is less abrupt than we had previously found to be the case further to the southward of Twofold Bay, where it was about 1 in 6. The bottom, which consists of soft ooze, then slopes down to a depth of 2,600 fathoms, at a distance of 240 miles from the coast, the temperature being 33 deg., which conditions continue for 140 miles. From this extreme depth the bottom slopes upward, with a gentle incline, with soft ooze, for 400 miles, until at a position 780 miles from Sydney and 335 miles from the entrance to Cook's Straits we obtained soundings in 1,100 fathoms. Between this and New Zealand only shallow soundings below 400 fathoms, with hard bottom, were obtained. The most westerly of these, 275 fathoms, was 300 miles from the land and 125 miles to the eastward of the 1,100 fathoms sounding. The shoal water evidently extends for some distance further to the westward, probably as much as 100 miles, which would give a total breadth of shallow water of 300 miles. The bottom on the shoal was extremely hard, so much so that we obtained little or no samples in the sounding rods; but as both the dredge and trawl dragged freely along, without catching any irregularities, it must have been of a smooth nature. On reference to former soundings on the general chart it is evident that a somewhat similar bank extends for a considerable distance to westward of the north cape of New Zealand; such being the case, the shoal is probably continuous, and shallow water may be expected all along the western side of North Island, but I see no reason to suppose that deep water does not extend to within a very short distance of the south-west cape of the Middle Island, which is also the nearest land to Australia.

During the past two weeks, Mr. Elisha Gray of Chicago, Ill., has been exhibiting his electro-harmonic apparatus in the Western Union Building, in this city. More than a year since we published an article descriptive of this curious discovery, so far as it had been developed at that time. Since then Mr. Gray has devoted the greater part of his time to the perfection of the apparatus, and has already succeeded in producing some very remarkable results. Mr. Gray's earlier experiments disclosed the fact that composite tones were as easily transmitted over a wire as single notes, and from this discovery he developed a system of multiple transmission, founded on this principle. The apparatus was tested experimentally on a wire between Boston and New York, on September 11th, with very satisfactory results. Four separate communications were simultaneously transmitted from Boston, and copied from four sounders by a like number of receiving operators in New York. In the main the signals were perfectly received on all the instruments, the only apparent defect being a tendency to shorten them somewhat, a difficulty which can doubtless be overcome by a suitable modification of the transmitting apparatus. The principle of the apparatus is a very simple one. Depression of each key sets a self-vibrating electrotome in operation, which is adjusted or tuned to vibrate at a certain rate, differing from that of any of the others, when under the influence of the electro-magnet controlled by its corresponding key. These several sets of electrical vibrations are transmitted through the circuit without interfering with each other, in the same manner that almost any number of different sets of sound waves may pass through the air without mingling. At the receiving station, each instrument is so adjusted as to respond to its own special sets of waves or vibrations without regard to others. By breaking and closing the circuit upon the transmitting electrotome, so as to form telegraphic signals, these are transmitted and taken up by the corresponding receiving apparatus. It is not easy to fix a limit to the number of different communications that may be carried on over the same wire simultaneously, either in the same or opposite directions. The marked success which has attended the operation of the principle through two hundred and forty miles of line, on September 11th, seems to promise results in the future of the greatest value.—(*Journal of the Telegraph.*)

Proceedings of Societies.

SOCIETY OF TELEGRAPHIC ENGINEERS.

The Society of Telegraph Engineers resumed their meetings at the Institution of Civli Engineers on Wednesday the 10th inst., Mr. Latimer Clark, President, in the chair. After the reading of the minutes several associates were passed to the degree of member, and a large number of new

candidates was announced. The President then referred to the progress of the Society, and drew especial attention of the meeting to the life and works of the late Sir Charles Wheatstone, a member of the society. Subsequently a vote of condolence was passed to the family.

A paper was then read—"On the respective "merits and durability of Guttapercha and India-"rubber joints," by Mr. HENRY MANCE, of which the following is an abstract:—

The following experiments were conducted at the head quarters of the Persian Gulf Telegraph department, Kurrachee, with the view of ascertaining the extent to which the different descriptions of joints might be relied on. The results obtained are communicated by the desire of the Director-in-Chief, in the hopes of eliciting further information on the subject from the Members of the Society of Telegraph Engineers.

Between fifty and sixty joints were submitted to observation. The jointer, who has had several years' experience, was aware that they would be carefully examined, and I have every reason to believe that great care was taken in preparing them.

It having been suggested that guttapercha joints are more liable to perish when exposed to the influence of water in the cable tanks, 9 joints were submerged in the Kurrachee Harbour for six months; the deterioration, however, was about the same as that previously noticed in those kept carefully wetted in the tanks.

The insulation of the Fao-Bushire guttapercha cable, which has scarcely been touched since it was first laid, is higher now than it has ever been, leading to the inference that guttapercha joints made in the factory at home, when the core was new, are not subject to such a decrease in their insulation resistance as is shown in those recently examined at Kurrachee. The question arises whether guttapercha a few years old can be jointed so successfully as that in newly-manufactured core. I do not speak of core, the outside coating of which is perished, but sound core, which, although well preserved, has been manufactured say five or six years. Should a joint properly made in good core of this age retain for twelve months the high resistance it shows when first tested?

Mechanically the *whole* of the joints were good and sound; there was no outward sign whatever to indicate any deterioration, and when cut open the workmanship appeared perfect.

The second indiarubber joint is the only one of that kind which tests low, but this is due not to bad jointing but to a small perforation in the core made by a "borer" whilst the joint was submerged in the Kurrachee Harbour. It is worthy of note that out of a large bundle of joints only one indiarubber joint was touched by the borer, and in this case it had not quite penetrated through to the conductor. Many of the guttapercha joints in the same bundle were riddled with holes by borers in the same time.

Thinking it possible that guttapercha joints might have stood the test of time better with less manipulation during manufacture, I had joints made with greater dispatch. The latter joints tested the best. It is very probable that joints are as often injured by over care as by too hasty manufacture. There is a point beyond which manipulation and the use of the spirit lamp will do positive harm.

The observations have already extended over a period of more than two years; several joints were cut open, but the whole of those included in the list have, with one exception, been replaced in the tanks for further examination.

REMARKS ON THE CONSTRUCTION OF LIGHTNING PROTECTORS FOR TELEGRAPH WIRES.

By F. SCHAACK,
Secretaire à la direction des Télégraph à Cologne.
(From the *Journal Telegraphique.*)

THE lightning protectors employed by the various telegraph departments differ considerably as to form, but their principle is the same, whether it is based on the system of points or plates. Their common object is to offer to the lightning which strikes the line as short a passage as possible to earth, and so protect the apparatus from its destructive effects.

The construction of lightning protectors with points or plates in the forms most generally adopted is respresented below by figs. 1 and 2.

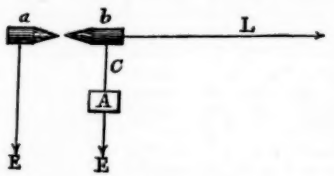

FIG. 1.

In fig. 1, *a* and *b* represent two metallic cones, the points of which are separated by a space of 0.5 mm.; *c* is a resistance formed by a wire of German-silver, which connects the instrument A with the cone *b*, that is to say with the line L. The cone *a* and the instrument A are connected to earth E.

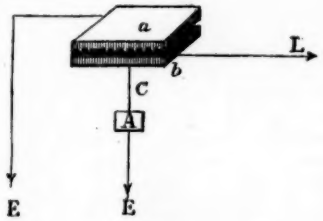

FIG. 2.

When the lightning traverses the line L it melts the resistance wire *c* (A is thus protected by being cut out of circuit) and leaps from *b* to *a*, and so escapes to earth.

In drawing No. 2, *a* and *b* represent two plates of metal laid very close together, the one above the other; their inner surfaces are grooved and insulated from one another by a sheet of paper; the grooves in the two plates cross each other, and by so doing form a series of points, offering a

more ready escape to the lightning. The other connections correspond with those in fig. 1.

This principle is in itself very simple, but when applied to a lightning protector, constructed to protect several wires, the numerous terminals for the connections with the line earth, instruments, &c., and the connections for ordinary working, as well as for the exclusion of the apparatus during storms, render the system very complicated, and liable to cause a great many faults.

The protectors, in fact, occasion faults which are for the most part to be attributed not only to atmospheric discharges, but rather to loose connections at the terminals, rupture of wires, short circuits produced by the proximity of the wires to the large mass of metal, and by moisture, which often connects the points, owing to the distance separating them being so small.

The first cost of fitting up is considerable, and reaches at least 25s. per wire, which, considering the number of stations, means the ex- penditure of considerable capital in fitting up.

On the other hand, the lightning in passing from one point to the other often fuses the points or melts them together. The repairs of these latter damages necessitate extra expenditure, inasmuch as they cannot be performed by the clerk, but require a skilled mechanic, which occasions considerable inconvenience to the service.

A lightning protector of the following construction remedies all these defects, and fulfils not only the desired object, but is a thoroughly practicable system; and on the other hand does not necessitate at most an outlay exceeding 25s. for a hundred wire protectors, and no expense for repairs, the clerk himself being able immediately to repair the damage done dy the storms. The most convenient position for the protector is near the batteries, so that the lineman, who looks after them, can at the same time see that it is in good working order. Figure 3 represents its construction in plan and section.

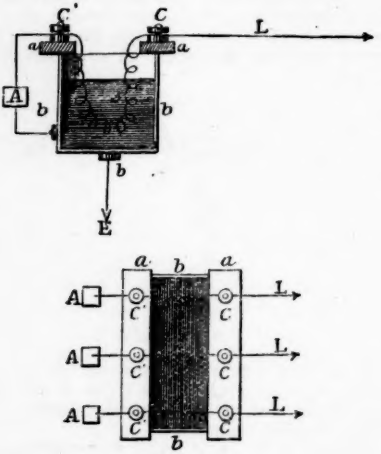

FIG. 3.

To the two sides of a cast-iron box *b b b*, about 10 centimetres in depth and the same in breadth, are fittted two strips of ebonite, *a a*, carrying the terminals for communication *c c'*. The line L is connected with the terminal *c*, and communicates by means of the terminal *c'* with the instruments A, which are connected underneath to the box of cast-iron and so to earth E.

The terminals *c* and *c'* are connected together by a German-silver wire (*s*) made into a large spiral. The wire is covered with silk, and dipped several times in a solution of Indiarubber, so as to form an insulating covering impermeable to water. The iron trough should be placed in the battery-room, on a floor affording a good earth connection, or else connected to earth by some other convenient method, and should be three parts filled with water.

Now when the lightning strikes the line the wire *s*, with its thin insulating covering, offers a very direct connection with the water, and so to earth; the spiral *s* will be fused or the insulating covering pierced, and will thus open a direct circuit to earth. As the ends of the broken wire might perhaps come in contact with the sides of the box, and so convey a portion of the atmospheric discharge through the instruments, it is preferable not to put them direct to earth, but to find earth by means of the iron box; by this foresight they will be completely out of danger from the discharge of the lightning.

After the storm the clerk replaces the broken wire by one in reserve, and the damage is repaired. The length of the iron box depends on the number of wires to be protected; a space of two centimetres will suffice for each. It must be remembered that this new form of protector will appear very primitive as compared with those generally in use, which are in themselves an ornament to our offices, and rank high in the opinion of those not versed in telegraphy, but as regards practical use and economical advantages we believe it fully deserves preference to any other form.

THE EGOTISM OF IGNORANCE.

(From the *Journal of the Telegraph.*)

WE published in our last issue that portion of the inaugural address of Sir John Hawkshaw, the newly elected President of the British Association for the Advancement of Science, in which he professed to outline the history of the electric telegraph.

The Society numbers amongst its members some of the foremost scientists of the day. It stands prominent in the front rank of similar bodies in the world of civilisation, and its discussions, deliberations, and decisions are read and regarded as authoritative by learned men in all countries.

The address of Sir John Hawkshaw, so far as it relates to telegraphy, is chiefly remarkable for what it does not contain. In no country more than the United States is the great truth acknowledged that science has no nationality—that it is cosmopolitan—and until this remarkable production appeared, and for which its author received the official thanks of his associate members, it was hoped that the scientists of Great Britain were in no whit behind in their acknowledgment of what was due to those who worked in the same field, but who, in the eyes of the average Briton, laboured under the disadvantage of not being born on British soil.

Comparisons are odious; yet we believe that the names of American discoverers and inventors which are comprised in the term "others" and tacked on to the tail end of the name of Sir Charles Wheatstone, will compare favourably with any furnished by Europe, and particularly by Great Britain, in the unparalleled advancement of electrical and telegraphic science which the last quarter of a century has witnessed.

AN EXPERIMENT FOR SHOWING THE ELECTRIC CONDUCTIVITY OF VARIOUS FORMS OF CARBON.

By H. BAUERMAN, F.G.S.*

(From the *Philosophical Magazine*.)

THE following simple method of exhibiting the conducting power of carbon was brought to my notice by my friend Mr. W. J. Ward, of the Metallurgical Laboratory of the Royal School of Mines, as having been shown to him several years since by Dr. von Kobell, of Munich. As I have not found any account of it published, I have ventured to bring it before this Society.

A fragment of the substance to be tested, whether charcoal, coke, anthracite, or other form of carbon, is held between the jaws of a pair of tongs formed by bending a strip of sheet zinc into a horse-shoe form, and immersed in a solution of cupric sulphate. If the carbon is a non-conductor, the copper salt is decomposed, and deposit of copper only takes place on the immersed surface of the zinc; but when it possesses a high degree of conductivity a zinc-carbon couple is formed, and deposit of copper takes place on the surface of the carbon as in ordinary electrotyping.

Of the different forms of carbon experimented upon, the most rapid results have been obtained with some American anthracites, and coals that have been subjected to the action of intruded igneous rocks. The most remarkable of these is an anthracite from Peru, which contains a large amount of sulphur in organic combination, and is found in a nearly vertical position, interstratified in quartzite, in the high plateau of the Andes, about 13,000 feet above the sea-level, near Truxillo. It is probably of secondary age, the metamorphism having taken place at the time of the great trachytic outbursts which form the gold-and-silver-bearing rocks of the adjacent mining-district. This is coppered by immersion almost as readily as graphite. The anthracite of Pennsylvania possesses the same property, but not in quite such a high degree. The heathen coal of South Staffordshire, when altered by the intrusion of the "white-rock" trap, is more slowly coppered; but this is probably due to the resistance interposed by the numerous laminæ of calcite filling the fractures in the mass of the coal, which renders the conductivity less perfect. A specimen of coal from Bengal, altered in the same manner by intrusion of igneous rock, behaves much in the same way as coke, being coppered directly. This is rather remarkable, as this coal is a very impure one, and contains such a large quantity of water very intimately combined, probably as a hydrated silicate interspersed through the mass, as to decrepitate explosively when suddenly heated.

The ordinary Welsh anthracite does not appear to be a conductor by this method, but after having been heated to a full red heat it conducts electricity freely. The lowest temperature at which this change takes place appears to be somewhere between the melting-points of zinc (430° C.) and silver 1000° C.), as fragments of anthracite packed in a thin clay crucible and plunged into molten zinc were not found to be altered, but were changed when heated in a bath of melted silver. These limits, although considerably wide apart, are interesting as giving a possible clue to the temperature at which anthracite metamorphism of coals has been effected in different districts. Mr. W. C. Roberts has recently shown that the alloys of silver and copper have very definite melting-points; it will be possible therefore to determine more nearly the lowest temperature necessary to produce the change.

In the South Wales anthracite district it is well known that no great amount of disturbance has taken place in the position of the coal-seams, while in North America and Peru the change has been accompanied with much more violent action, as evidenced by the greater disturbance of the rocks; and probably a correspondingly higher degree of heat was developed in the mass. The evidence afforded by the coals that have been actually altered by intruded rocks, and must have been highly heated, appears to bear out this view. On the other hand, long-continued exposure to a lower temperature might possibly produce the same effect, and further experiments upon this point would be desirable.

* Read before the Physical Society,, May 22 1875.

THE ELECTRIC LIGHT.

SINCE Sir Humphrey Davy exhibited the electric light for the first time in England at the Royal Institution, more than half a century ago, it is surprising what little practical use we have been able to make of this most brilliant source of illumination. It has been employed from time to time for illuminating works at night, and has also been adopted in one or two lighthouses—that of the South Foreland, for instance, where the spark, at a distance of thirty miles, looks like a star of the first magnitude; but the difficulty of securing a constant light has always stood in the way of a widespread application of so valuable an illuminating agent. One main difficulty connected with the matter was surmounted by Faraday when he discovered that electricity could be induced by magnetism, and thus we are enabled at the present day by simply turning a handle and causing a series of armatures to revolve in front of magnets, to produce a light as vivid and intense as that which in the days of Sir Humphrey Davy necessitated a battery of four thousand metal plates. But we have made little progress in respect to the electric lamp itself, and there is still the same difficulty as of old in maintaining a constant spark between the two carbon points of the apparatus, although the interruptions are certainly far less frequent than they used to be. In the condition, however, in which the electric light is at present, there should be many useful appli-

cations of it to be found, and we are glad to see that the Lords of the Admiralty, in making their present tour of inspection, looked with much favour on some electric experiments made on board the *Minotaur* at Portsmouth. Among other things, it was shown that a vessel provided with an electric light could detect the approach of a hostile craft, no matter what colour it was painted, at a distance of a mile; and further, that the grey paint which covers the sides of many of our war vessels, and which was supposed to be the most invisible of colours, stands out with particular clearness when illuminated by electricity. An electric lamp would therefore be an element of safety in preventing the approach of torpedo-launches and such like dangerous craft without being observed, and the beam of intense light would serve also for signalling at night with a battery on shore, or with other vessels of a fleet or squadron. The Admiralty, we are told, have ordered further trials with the light, and if favourably reported upon, we may hope to find all our ironclads provided with an electric lamp. In the case of a dense fog, such as that prevailing at the time the *Vanguard* was struck, such a light would be particularly valuable.—(*Daily News.*)

TELEGRAPHIC PROGRESS IN AMERICA IN 1874-5.

(From the *Journal of the Telegraph.*)

THE sum of the progress of the electric telegraph in the United States is comprised in the history of the Western Union Telegraph Company, and this is fully illustrated and set forth yearly in the reports of the president of that company to the stockholders. In the report for 1874-5, Mr. Orton presents a very flattering exhibit of the financial condition of the company, upon which there is no occasion for comment except it be as a subject for congratulation. But to its character as a record of the progress made during the twelve months embraced in the report we desire to call attention.

We find that on June 30th the company were operating 6,565 offices, with 179,294 miles of wire upon 72,833 miles of poles. The comparatively small increase in mileage over previous years, however, is only an apparent one. The actual increase has been not less than 30,000 miles of wire, evoked, as it were, out of nothing. The improved apparatus introduced, in doubling and quadrupling the carrying capacity of a wire, has virtually materialized a "phantom," as Mr. Orton aptly terms it, and which materialization is utilized without any expense for maintenance. The benefits of telegraphic communication have been conveyed to 377 places which heretofore had been without this convenience. This number is a little below the average of the previous eight years, but it is to be accounted for in the almost complete cessation in the construction of railways and the consequent decrease in the formation of new towns and settlements. The number of messages transmitted, shows an increase of 824,454 over the preceding year; the total number being 17,153,710. The number of telegraphic money transfers, a service of great value to the public, and which is peculiar to the Western Union Company, has largely increased. About 2,000,000 dols. was received and paid out at the various offices.

But it is in the question of rates charged for transmission that the public have the greatest concern. The report shows that even with a reduction in expenses to the extent of over $420,000, as compared with the previous year; the actual cost of handling a message between points distant from one to twenty-five miles, is not less than twenty-six cents. This important fact alone proves the impossibility of successfully establishing a postal system at a uniform rate of twenty-five cents to all points of the country, which was the rate fixed upon by the advocates and promoters of those pernicious schemes, and upon which was based the expectation of popular support.

Since 1867, the yearly average increase in the number of messages transmitted has been twenty-four per cent., and during the same period the tolls have been reduced fifty-one per cent. This reduction is greater in the aggregate than has ever been made upon the entire traffic of any other telegraph system in the same period of time.

Altogether the telegraphic interests of the country could hardly be in a better condition. Invention is encouraged, and improvements are welcomed. The eminently wise and sagacious policy pursued by the leading Company affords entire satisfaction to the public. These facts and the certainty of their continuance presents an augury of the future promising in the highest degree.

Correspondence.

AN IMPROVEMENT IN MORSE APPARATUS.

To the Editor of the TELEGRAPHIC JOURNAL.

SIR,—When a Morse spring breaks, four or five of the teeth on the barrel, and occasionally other wheels follow *en suite*, caused by the violent expansion of the spring and consequent rebound of the drum. To prevent this extra damage we must either stay the expansion of the spring or allow it to run down free of the other clockwork. The latter may be effected by having the pinion (in which the teeth of the barrel work) tapped, and screwed on its axle in such a manner that the rebound of the drum unscrews the pinion which would be left loose on the axle, and thus allow the spring to run freely down and do no other damage. Of course, this arrangement will not prevent the breaking of springs, but it will avoid all damage arising therefrom.

This could easily be applied to the present instruments at a trifling cost, and would, I think, be an improvement.

H. G. CHEESMAN,
Porthcurnow, Sep. 20th. Ass. Soc. T.E.

Notice to Correspondents.

C.D.—Elisha Gray took out a patent on July 29th, 1874, for "improvements in the method of, and apparatus for, transmitting musical tones by electricity." His specification, in his agent's name—Johnson—is No. 2,646. See description under heading "Notes" in this number.